

TESTS WITH VARIOUS AMOUNTS OF ORTHODICHLOROBENZENE
IN DIESEL OIL FOR CONTROL OF THE MOUNTAIN PINE BEETLE -
WASATCH NATIONAL FOREST, 1942

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Introduction.--During the past three seasons, control work against the mountain pine beetle (Dendroctonus monticolae Hopk.) in lodgepole pine on the Wasatch National Forest has been carried out with a penetrating oil spray. This method has been used in early summer after the fire danger becomes too great to use the decking and burning method. The formula for the penetrating oil during 1940 and 1941 was 1 part orthodichlorobenzene by volume to 4 parts fuel oil by volume. Recent tests by the Forest Insect Laboratory at Coeur d' Alene, Idaho, have shown that good results can be obtained with less ortho in the solution. A decrease in the amount of the ortho reduces the cost of the spray and also conserves the ortho which is difficult to obtain during the present war emergency. On the basis of the results obtained at the Coeur d' Alene laboratory, the amount of ortho in the formula for control work on the Iron Mine unit during 1942 was reduced to 1 part ortho to 5 parts fuel oil. To determine whether the amount of ortho could be further reduced and yet obtain good results, some experimental tests were made during July 1942 on the Iron Mine unit using 1:6, 1:8, and 1:10 solutions. The tests were carried out by the U. S. Forest Service under the supervision of Bruce Groves, Assistant Forester and Ben Swapp, Foreman in Charge, both of the Forest Service, and N. D. Wygant of the Bureau of Entomology and Plant Quarantine. The results of the tests were determined by Clark Miles of the Forest Service Regional Office and N. D. Wygant. The purpose of this report is to summarize the work and present the results.

Treating Methods.--The treating method on the experimental trees was the same as that used during the regular control work with penetrating oils. The trees were felled, limbed, and bucked at the upper limits of the infested stem. The logs were sprayed from the top side and rolled to spray each successive sector.

Size and Location of Trees.--In common with the lodgepole pine on the Iron Mine unit, the experimental trees were large, overmature, and thick-barked. The average DBH of the 40 experimental trees was 17.5 inches with a range from 13 to 24 inches. The average size of the trees in each test is shown in table 1.

Half of the trees in each test were on a gentle south slope and the other half on a flat to gentle north slope. Those on the south exposure were sprayed on July 7 and those on the north exposure on July 17. The difference in the exposure of the two areas is not deemed to be great enough to provide a measure of the effects of exposure on the lethal action of the spray; therefore, the results are grouped to provide a larger sample.

The elevation in the area of the experiment is approximately 9,500 feet. Weather conditions were favorable at the time of spraying.

Table 1.--Summary of Tree Size and Amount of Penetrating Oil Used for the Experimental Tests, July 7 and 17, 1942.

Parts by Volume Ortho to Fuel Oil	Number of Trees	Average DBH in Inches	Total Amount of Solution Used in Gallons
1 : 6	10	16.4	17.5
1 : 8	10	18.7	21
1 : 10	10	18.0	22
Check	10	16.8	0

Brood Conditions.--Effort was made to select trees with good brood; but, as was determined later, the brood in most of the trees was limited to the first 5 to 10 feet of the stem. Although the attacks were heavy and continued well up the stem, the insects failed to develop beyond the egg stage in the upper part of the stem. The bark on the parts of the stem where the brood failed to develop was dry and tight to the xylem.

The winter of 1941-42 was passed in the parent adult and egg stages and to a small extent in the newly hatched larval stage. Normally the insect passes the winter in the larval stage, partly to full grown. Cool weather during 1941 apparently retarded development. Continued cool weather during the spring of 1942 further delayed development. At the time of the spraying many of the trees still contained small larvae. On August 5 when the results of the tests were checked upon, most of the brood was in the larval stage, and a small amount in the pupal stage.

Sampling the Results.--The experimental trees were examined by Clark Miles, and N. D. Wygant on August 5 to determine the results of the tests. The stems were examined on all sides and where survival of the brood occurred, the bark was removed to determine the extent of the bark area under which mortality was not complete. The check trees provided a comparison of mortality in the unsprayed trees to the mortality in the sprayed trees.

Results.--The results of the tests with the three different sprays are summarized in table 2.

Table 2.--Summary of Results

Parts Ortho to Fuel Oil by Volume	Number of Trees with				
	100% Mortality of Brood	Small Patch of Living Brood	Survival of Brood Quite General	Normal Brood Devel- opment	No Brood at Time of Treatment
1 : 6	8	0	1		1
1 : 8	4	2	3		1
1 : 10	0	4	5		1
Check				9	1

The 1 : 6 spray gave perfect control on all of the trees except one. This tree was 16.0 inches in diameter, its bark not unusually thick, and like many of the other trees, brood developed only in the butt of the stem. There appeared to be very little mortality of the brood in this tree from the spray; however, the total number of beetles developing in the tree was small because of the brood being limited to the butt.

The 1 : 8 spray gave perfect control on 4 trees; satisfactory, but with an occasional surviving insect on 2 trees; and unsatisfactory control, because of quite general survival on 3 trees.

The 1 : 10 spray gave perfect control in no trees, satisfactory but with an occasional surviving insect on 4 trees, and little control on 5 trees.

Of the 10 check trees, 2 contained heavy brood, 2 medium brood, 5 light brood, and 1 tree contained no brood. Even in the trees containing the heavy brood the population decreased progressively up the stem.

A number of the trees sprayed during the regular control work with the 1 : 5 spray were checked to determine the results. The mortality was complete in most of the trees, but an occasional one contained considerable brood in the butt. It was apparent that the 1 : 6 spray was as effective as the 1 : 5 spray. The 1 : 6 spray apparently contains the minimum amount of ortho that can be used with good results. If it were possible to get uniform and complete coverage with a spray it is believed that the 1 : 8 spray would give as good results as the 1 : 6 spray. However, on the basis of the present tests it cannot be recommended. While the 1 : 10 spray caused considerable mortality, the results show that the amount of ortho is definitely too little to be effective.

Conclusions and Recommendations.--The results of the tests show that a penetrating oil of 1 part ortho to 6 parts of fuel oil contains the minimum amount of ortho that can be used with good results against the mountain pine beetle under the conditions that prevail on the Wasatch National Forest, where the lodgepole is large, overmature, and thick-barked. While the 1 : 8 spray

produced good results, the mortality was not complete in many trees. Therefore, the 1 : 6 spray contains the minimum amount of ortho that can be recommended for regular control work.

In checking the results of the control work with the 1 : 5 spray, it was evident that the penetrating oil is not killing the "last insect" in a number of the treated trees. The survival occurs for the most part in the butt of the stem where the bark is usually much thicker. In addition to bark thickness, factors which are not apparent also influence the penetration of the lethal oil. Some of these factors may be bark texture and moisture content. For example, perfect control was obtained on 8 of the 9 trees with the 1 : 6 spray; but this tree that contained considerable survival was only 16 inches in diameter or slightly smaller than the average of the 9 trees, and the bark was about average in thickness.

While it may be impossible and also not necessary to kill the "last insect" in every tree with a penetrating oil spray as used at the present, results probably can be improved upon by using certain added measures. Since most of the survival occurs in the butt, an improved kill might be obtained by applying an extra amount of the spray to the basal 4 or 5 feet of the stem or by spraying the butt twice. Hacking through the bark on the stump before spraying has produced good results. Such a method may be worthy of a test to determine the spacing necessary for the hacks and to determine the added cost when such a procedure is followed on the butt.

The necessity of uniform and complete coverage with the spray cannot be too strongly impressed upon the men doing the work. To obtain complete coverage of the log with the spray is relatively easy. To obtain uniform coverage and not leave spots and strips of bark with very light coverage is difficult; therefore, the most diligent man of the control crew should be selected to use the sprayer. The men doing the spraying should be carefully trained and well supervised. The quality of control work by decking and burning can be checked by the supervisor at a later date, but with the penetrating oil method the work must be checked at the time of the spraying.